Walker

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No. 8.

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THE MALE GENITAL ARMATURE OF THE THYSANOPTERA*

BY J. J. DE GRYSE AND R. C. TREHERNE.
Ottawa, Ont.

The Order Thysanoptera, according to the writings of Handlirsch and Karny[1], has arisen from an orthopteroid stem. It is the opinion of the authors of the present paper that the study of the genitalia will aid materially in a final determination of the true position of the Thysanoptera among the other insect Orders. We are not aware of any effort by writers on the North American continent to study the structure of the genital organs of the Thysanoptera. Crampton, Walker, Newell, all of whom have dealt minutely with the phylogeny and morphology of the terminal abdominal structures of the Orthoptera and allied Orders, do not mention the Thysanoptera. In view of the fact that this Order is receiving considerable attention at the hands of students and that the number of described species has about trebled in the last decade, with the possible confusion of many species which have been described on color characteristics, it is probable that more cognizance of the abdominal structures must be taken in the future, particularly in consideration of the importance of these structures in the other Orthopteroid insects.

The shape and setal armature of the tenth and eleventh tergites; the degree of chitinization of the hypandrium with the relative length of its prominent setae; and the shape of the coxal lobes and coxites of the ninth somite, will doubtless be of importance in the separation of both genera and species in the Order. Furthermore, the presence, absence or number of teeth on the posterior margin of the eighth tergite, the arrangement and number of setae and punctures on the posterior margin of the ninth, tenth and eleventh tergites and the depth, shape and relative size of the depressions on the abdominal sternites will be found useful.

The following is a preliminary effort to arrive at some suitable definition of the terminal structures of the male abdomen. With few modifications, the terminology applied to these structures is that proposed by Berlese[2]. No attempt has been made at giving to the component parts of the principal structures or their minor processes such names as are usually proposed by systematists, and which are difficult to harmonize since their application varies from order to order and often from group to group. The genital armature only is considered in this paper, other organs, testes, ducts, etc., and their relations to the armature, it is hoped will form the subject of a future paper.

The Somites or Urites. Hinds[3] in his monograph on the North American Thysanoptera, 1902, states that "the abdomen is always composed of ten segments." Pietro Buffa[4] in his treatise on Italian Thysanoptera (1907) illustrates the terminal abdominal segments of *Megalothrips lativentris* Heeger, *Taeniothrips* (*Physapus*) *primulae* Haliday, *Heliothrips haemorrhoidalis* Bouche and *Aeolothrips fasciatus* Linn., and in each case has determined the presence of

*—Contribution from the Dominion Entomological Branch, Ottawa, Ont.

eleven segments. From our studies of the males of *Aeolothrips fasciatus* Linn., *Taeniothrips orionis* Treherne, *Frankliniella insularis* Franklin, *Leptothrips mali* Fitch, *Trichothrips americanus* Hood, we have arrived at the same conclusions as Buffa with regard to the number of abdominal somites. In the plate (fig. 13) we give a diagrammatic median sagittal section of the terminal urites of a hypothetical Thysanopteron.

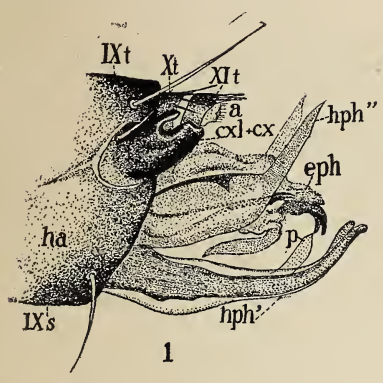
Figure 1 illustrates the terminal somites of *Aeolothrips fasciatus* Linn. in lateral view with the phallic appendages extruded. The ninth, tenth and eleventh tergites are clearly visible and are represented by conspicuous chitinizations bearing setae.

The ninth sternite (IXs), which is of very large proportions, forms the subgenital plate (ha). The tenth (fig. 2 pa) is invaginated and to it are attached the large abductor and adductor muscles of the genital apparatus, as well as the penis or phallus and its accessory structures. The same fundamental plan is present in *Taeniothrips orionis* Treherne (figs. 10, 11, 12) and *Frankliniella insularis* Franklin (figs. 4, 5, 6). In *T. orionis* Tr. the chitinization of the eleventh tergite is, at best, very slight but the setae are easily distinguishable, whereas in *F. insularis* Fr. the eleventh tergite is represented by a small but distinct plate bearing two setae (fig. 6).

In the *Tubulifcrae,* the tenth and eleventh tergites are fused and are not separated as represented by Buffa. The eleventh sternite forms with the tenth and eleventh tergites a long tube at the end of which the anal opening is situated (fig. 7).

The Subgenital Plate or Hypandrium. In its primitive form the ninth sternite consists of three plates, a basal sclerite and two lateral processes which are produced distally. This structure is most readily seen in an examination of *Frankliniella insularis* Fr. (fig. 4), where the lateral processes are separated from the basal sclerite by a marked chitinization. The term *hypandrium* was proposed by Crampton[5] to designate the male subgenital plate. According to Walker[6] it may be used to designate the sclerite whether it be the entire ninth sternite or its distal part only when the sternite is transversely divided. Walker points out that the term is open to objection as it tends to obscure the homologies of the parts concerned, although it is a convenient one for descriptive purposes. For the sake of clearness as well as on account of its agreement with other terms employed in this paper, we have adopted the term "hypandrium" to designate the ventral or basal sclerite of the ninth sternite (figs. 1, 3, 7 ha). For the distolateral sclerites we have adopted the term "coxal lobes" whilst to their clasper-like processes the name "coxite" is applied (figs. 1, 4, 7, 10 cxl, cx).

Coxal Lobes and Coxites. In *Aeolothrips fasciatus* Linn. there appears on the dorso-lateral angles of the hypandrium a rather short but distinct chitinous plate bearing setae and a bifid hook-like process as illustrated in figure 1. These are, in our opinion, the *coxal lobe* and *coxite* (cxl and cx). Their homologues are found variously modified in the other sub-divisions of the Order. In *Taeniothrips* and *Frankliniella* the coxal lobes are large and distinctly divided from the hypandrium at their dorsal margin. Laterally and ventrally they are fused with this sclerite; the coxites are merely vestigial (fig. 4 & 10 cx). In these *Tubulifcrae* which we have examined, the dorso-lateral angle of the hypan-



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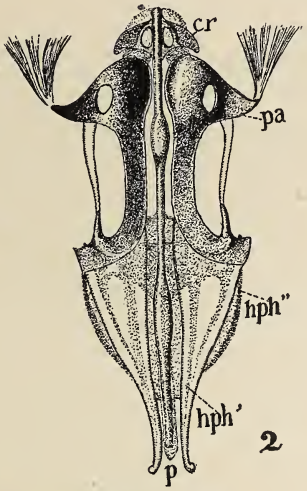

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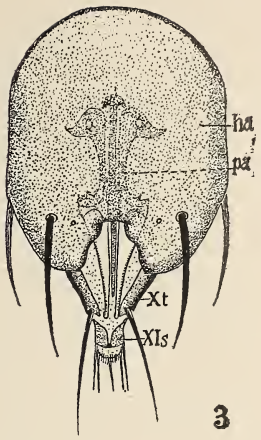

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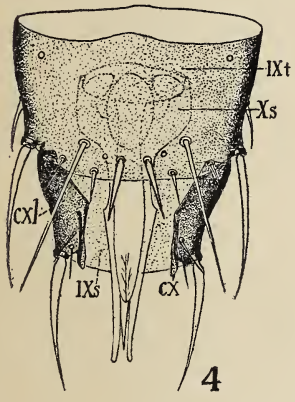

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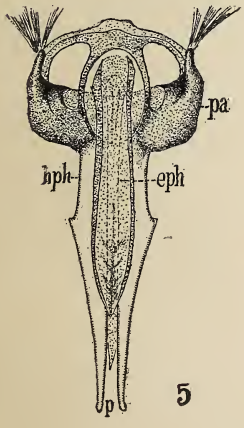

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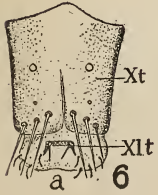

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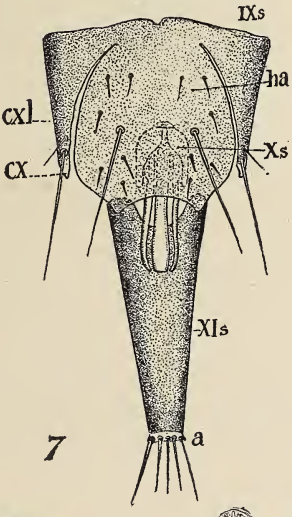

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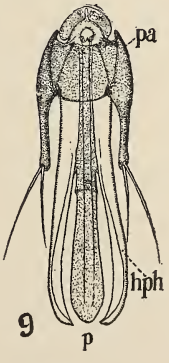

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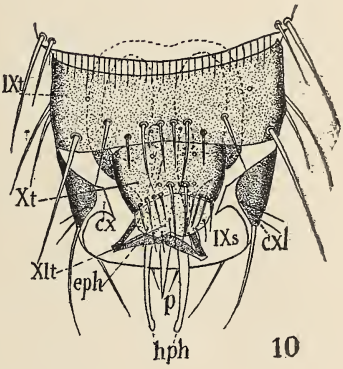

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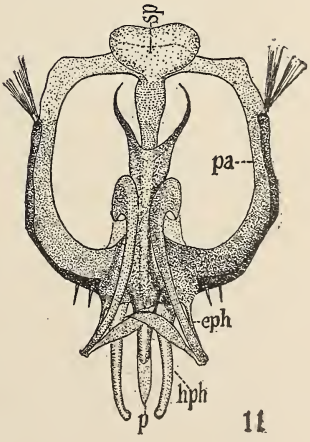

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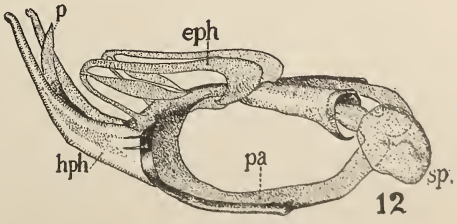

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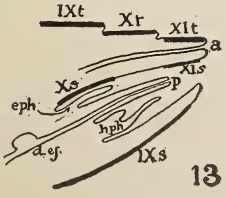

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MALE GENITAL ARMATURE OF THYSANOPTERA

drium bears a simple blunt or sharp process in which no parts can be distinguished (fig. 7).

Genital Opening, Ductus Ejaculatorius, Phallus. Hinds (loc: cit:) says: "the sexual opening is between the ninth and tenth segments and frequently from this point there protrudes more or less of the copulatory apparatus, which is usually entirely drawn into the ninth segment through the walls of which it can be more or less distinctly seen." In all Thysanoptera the genital opening is borne upon a somewhat chitinized penis or phallus which is variable in shape and length, being a modification of the perigenital membrane. In this paper the term phallus is applied in a comprehensive manner to include the various parts designated by authors as ductus ejaculatorius, virga, and glans penis, etc. At or near the base of the phallus we often find the spermatophore sac (sp) and in some forms a peculiar chitinous structure, probably the homologue of what Walker[6] calls "a pair of glandular pouches, lined with chitin which open separately or by a common duct into the ejaculatory duct" (fig. 2, cr).

The Periphallus. The complex of structures surrounding the phallus, and morphologically of the same origin as this organ, is called the *periphallus.* These structures are known as *hypophallus* (hph.) and *epiphallus* (eph.), their names indicating their relative positions with regard to the phallus.

The Hypophallus (parameres of Verhoeff) in Thysanoptera seems to consist primitively of two sets of structures, probably homologues with Chopard's "valves dorsales" and "valves ventrales" of the Orthoptera[7]. The ventral valves (hph') are present in all forms, their shape varies only in minor details throughout the Order. The dorsal valves (hph") are seen in *Aeolothrips* as moderately conspicuous plates bearing on their distal margin an elongated semi-membranous process (fig. 1) attached laterad of the phallus. It is the ventral valves of the hypophallus that are the most conspicuous structures found protruding beyond the eleventh somite in a normally mounted specimen.

The Epiphallus. Under this term are included the greatly variable structures originating dorsad of the phallus. In *Aeolothrips fasciatus* Linn this consists of a semi-membranous appendage borne on two thin chitinous rods at the extremity of which is a double strongly chitinized hook (fig. 1, eph). Cephalad of the latter there is a transparent, unpaired, flattened hook. In *Taeniothrips* the ephiphallus is represented by two thinly chitinized arms with double attachments and forming an arch which bears an elongated, hinged, membranous, freely movable process (fig. 11, 12, eph). In the species of *Aeolothrips* and *Taeniothrips* examined, the epiphallus ranks next in prominence to the ventral valves of the hypophallus. In *Franklinicllu* the epiphallus seems to consist of a very thin plate which may be bipartite (fig. 5, eph). No corresponding structure was found in the species of *Phloeothripidae* examined.

The Periandrium. The chitinous plates to which are attached the muscles governing the retraction and protrusion of the genital apparatus, have been interpreted variously by different authors. When retracted into the body they can easily be seen in transparency under low power of the miscroscope. We consider them as representing the invaginated tenth sternite to which, following Berlese, we have applied the name *periandrium* (pa). Its processes have been designated

by different authors as arches, arms, rami, endapophyses, and vary widely in shape in the different forms we have studied. These variations are illustrated in fig. 2, 5, 8, 9, 11, 12, pa).

The variations here discussed warrant the belief that they will prove of taxonomic value in the separation of both genera and species. The phylogenetic relations referred to by Hood[8] in which the superfamily *Aeolothripoidea* is placed as the most generalized and the *Phloeothripoidea* the most specialized, with *Thripoidea* as intermediary, appear to be borne out by the study of the male genitalia.

Abbreviations.

IXt-XIt—9th, 10th, 11th tergites; IXs-XIs—9th, 10th, 11th sternites; cx—coxite; cxl—coxal lobe; a—anal opening; p—phallus; eph—epiphallus; hph—hypophallus; hph'—ventral valve of hypophallus; hph''—dorsal valve of hypophallus; pa---periandrium; ha---hypandrium; sp---spermatophore sac; d, ej---ejaculatory duct.

Explanation of Plate

Fig. 1. *Aeolothrips fasciatus* Linn., side view of terminal somites of male with genitalia extruded.
Fig. 2. *Aeolothrips fasciatus* Linn., male genitalia in ventral view.
Fig. 3. *Aeolothrips fasciatus* Linn., ventral view of terminal abdominal somites.
Fig. 4. *Frankliniella insularis* Franklin, ninth somite, in dorsal view (tenth and eleventh tergites removed.
Fig. 5. *Frankliniella insularis* Fr., male genitalia in dorsal view.
Fig. 6. *Frankliniella insularis* Fr., tenth and eleventh tergites in dorsal view.
Fig. 7. *Leptothrips mali* Fitch, terminal abdominal somites of male in ventral view.
Fig. 8. *Leptothrips mali* Fitch, male genitalia in dorsal view.
Fig. 9. *Trichothrips americanus* Hood, male genitalia in dorsal view.
Fig. 10. *Taeniothrips orionis* Treherne, terminal abdominal somites of male in dorsal view (slightly spread apart).
Fig. 11. *Taeniothrips orionis* Tr., male genitalia in dorsal view.
Fig. 12. *Taeniothrips orionis* Tr., male genitalia in lateral view.
Fig. 13. Diagrammatic median sagittal section of the terminal urites of a hypothetical thysanoptera.

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THE ODONATA OF THE THUNDER BAY DISTRICT, ONTARIO.

BY E. M. WALKER,
University of Toronto, Toronto.

(Continued from page 176.)

23. *Aeshna sitchensis* Hagen. We have not met with this northern species in the Nipigon region, but there is a male in the Carnegie Museum from Silver Islet, Lake Superior, July 9, 1913. It has also been reported by Adams from Isle Royale.

24. *Aeshna juncea* L. This Hudsonian species flies at Nipigon over the reed beds and open marshes along the river below the railway. On Aug. 4 to 8, 1910, they were common and in good condition, while on Aug. 28 to 30, 1907, they were somewhat worn. Two males taken at Nipigon by the late Dr. James Fletcher, on July 10, 1907, were teneral. It has not been observed about Lake Nipigon.

25. *Aeshna subarctica* E. Walk. This species was taken with *juncea* and the following three species at Nipigon, all flying together over the open marshes and reed beds along the river. It was taken on the same dates, exclusive of the July record, and appeared in about the same numbers as *A. juncea.*

26. *Aeshna interrupta interrupta* E. Walk. Common at Nipigon, Aug. 28-30, 1907, and Aug. 6-8, 1910. On the former dates it outnumbered *A. eremita,* on the latter dates the reverse was the case. In general it is the later-appearing species of the two, as I have observed in various localities and seasons. Five exuvia and a nymph of the penultimate stage were also found on Aug. 6-8, 1910. In 1920 we did not observe the adult at Orient Bay, though a few exuvia were found on July 19 in the open marsh at the mouth of the Pustagone River. The season of emergence had probably just begun about that time. Mr. Bigelow took 3 males on July 3, a pair on July 24, 1921, and a female on July 18, 1922, at Orient Bay, and the species is undoubtedly common here during the latter part of summer. Eight nymphs representing 6 stages were also taken from a small lake near Macdiarmid on Aug. 13, 1922, by the Fisheries Research party. One of these was full grown, the others belonging to various stages, including the three preceding the final instar, and two much younger. Two other series of nymphs were collected by Mr. J. L. Hart of the Fisheries Research party of 1923 from a small lake near Macdiarmid. One of these series was collected on July 24 and consists of three specimens, one of which is 7.5 mm long, the others from 13 to 14 mm. long. The other series consists of 16 specimens, of which two are full grown and the remainder belong to various earlier stages, ranging in length from 9 to 22 mm. Of these nine are from 9 to 10 mm. long and together with the small nymph of the first series, represent a stage hitherto unknown and remarkable for the sharply angular hind angles of the head and for the peculiar coloration, which is very dark with the appendages

and 10th. abd. seg. whitish and a broad whitish band across the hind part of the thorax, including the wing-buds, and the first two abdominal segments. This is a type of coloration seen in very young nymphs of certain other Aeshnines, such as *Anax junius*. Had these specimens been taken elsewhere or in the absence of other stages it would have been difficult to determine even their generic position, as the angulate margins of the head are contrary to the generic characters of Aeshna nymphs as commonly understood. But the next-sized specimens, which measure 12m., and which evidently belong to the next stage, resemble it closely in all structural details except that the angles of the head are rounded, as in the later stages of *interrupta*. The coloration differs in the absence of the pale bands and the somewhat paler ground of the abdomen. All other regional Aeshnine genera being excluded, there can be little doubt that these young nymphs belong to *A. interrupta*, and that there is a sudden change at the next moult in the form of the head in this respect. It is a feature, however, that is certainly not present in some, if any, of the other native species of the genus, such as *A. umbrosa* and *A. canadensis*.

There is an adult specimen in the Carnegie Museum collection from Ombabika Bay, Lake Nipigon, (Mrs. Jennings) and I have a ♂ and ♀ from Fort William, taken on Aug. 2, 1910..

27. *Aeshna eremita* Scudd. Common and generally distributed, the earliest Aeshna to mature. It was abundant at Nipigon on Aug. 4-8, 1910. Exuvia were numerous and nymphs of four stages were found, including two full-grown specimens, which were kept alive but did not transform that season. Adults were also found here on Aug. 28, 1907, but were much scarcer. At Orient Bay in 1920, July 16-24, it appeared on all the slow streams, all examples seen being fully mature. On July 20, I heard a rustling of wings among the rushes along the edge of Bear Creek. On investigating I found a female *eremita* ovipositing, but finding it could not rise from the water I picked it up and found the cause of the trouble to be a full-grown nymph of its own species, which had captured it by the abdomen and was in the act of devouring it.

A number of male adults were also captured at Macdiarmid on July 24, 1921, by Mr. Bigelow. Two adults, male and female, and a fullgrown female nymph were taken by the Fisheries Research party at Black Sturgeon Lake, July 20, 1922. Three nymphs of the penultimate stage were also taken by this party at Orient Bay and at a small lake near Macdiarmid, Aug. 11, 1922, July 31, 1923, and Aug. 12, 1922, and two of the antepenultimate stage by Mr. Hart in the same vicinity on July 7 and Aug. 15, 1923. Fragments of a full-grown nymph were found in the stomach of a golden-eye duck, shot by Mr. L. Snyder of the same party.

In the Carnegie Museum collection there are two specimens of this species from the north end of Lake Nipigon and from Porphyry Island, Lake Superior, July 22, 1913, taken by Mrs. Jennings; and 1 male and 2 females from Silver Islet by R. H. Dailey.

28. *Aeshna canadensis* E. Walk. Nipigon, Aug. 28-30, 1907, and Aug. 6-8, 1910; common but less so than the preceding species. At Orient Bay in 1920, we first captured it on Bear Creek, July 19, after which it became rather common. It was met with in the marshes of the Pustagone, Bear Creek, and

other similar localities. Mr. Bigelow also collected specimens with the following data, Macdiarmid, July 17, 1921, 1 ♀ ; Sept. 5, 1923, 1 ♂ ; Grand Bay, July 22, 1921, 1 ♀ , Black Sturgeon Bay, July 19-21, 1922, 5 ♂ 5 ♀ .

The Carnegie Museum contains a specimen from the "North end of Lake Nipigon," taken by Mrs. Jennings, and 2 males from Silver Islet Town, Aug. 4 and 14, 1912, by R. H. Dailey. Finally I have a male from Fort William, taken on Aug. 2, 1910. Neither nymphs nor exuvia have been found in any of these localities.

29. *Aeshna umbrosa umbrosa* E. Walk. Nipigon, Aug. 28-30, 1907; Aug. 5, 1910, 3 ♂ 1 ♀ . It was scarce at Orient Bay when we arrived in 1920 the first specimen having been taken on July 16 on Bear Creek. Later it became common about all the creeks in the vicinity. Specimens with the following date were taken by Mr. Bigelow; Macdiarmid, Aug. 24, 1921, 1 ♂ 1 ♀ ; Pustagone R., Aug. 28, 1923, 1 ♂ 1 ♀ ; Small lake on hill top near Macdiarmid, Aug. 12, 1922, 1 ♂ ; Black Sturgeon Bay, July 21, 1922, 1 ♂ ; Grand Bay, Aug. 23, 1921, 1 ♀ ; Wabinosh, July 28, 1923 1 ♂ .

Nymphs of various stages were dredged from the following localities in the vicinity of Lake Nipigon---Pustagone River, July 20, 1921, 1 very young; Orient Bay, June 30, 1 penult; July 29, 1921, 1 penult.; June 12, 1921, June 23, 1922, 2 full-grown; Aug. 12, 1922, 3 penult.; 5 younger; Aug. 11, 1921, 5 full-grown, 2 penult.: inland lake near Orient Bay, June 3, 1921, 1 penult.; small lakes near Macdiarmid, July 8, 1922, 1 very young; July 24, 1923, 1 full grown; Aug. 1,3, 1923, 1 antepenult ("very turbid water, cold stony bottom"—J. L. Hart); Sept. 13, 1923, 1 very young; Sakespeare Bay, Aug. 12, 1921, 2 penult; 1 antepenult.

The Carnegie Museum contains a specimen from the north end of Lake Nipigon (Mrs. Jennings) and a male from Silver Islet Town, Aug. 4, 1912, (R. H. Dailey) ; and the writer took a number of males near Fort William, flying over a ditch beside a road through a spruce swamp, Aug. 26 and 27, 1907.

The full-grown nymphs recorded above would probably have all emerged the same season, with the possible exception of those taken in August, while those of the penultimate and antepenultimate stages belonged to the next year's brood.

30. *Anax junius* Drury. The Carnegie Museum contains a male from Silver Islet, dated July 9, 1913. This is the most northerly record of this species from eastern Canada, the specimen having been perhaps a wanderer from the south.

31. *Didymops transversa* Say. We did not meet with this species in the Nipigon district and no adults have yet been taken, but 4 nymphs, including a full-grown female and 3 of the penultimate stage, were dredged by members of the Fisheries Research party from a small lake near Macdiarmid, Aug. 4, 1922. This is the most northerly locality from which it has been obtained.

32. *Macromia illinoiensis* Walsh. This species, which we did not meet with, was taken at Wabinosh by Mr. Bigelow on July 28, 1923. Two pairs were taken in copula. Mr. Bigelow states that they were quite abundant. Nymphs of this species, mostly very young, were found in considerable numbers in the stomachs of four sturgeon, collected by Mr. W. J. K. Harkness of the

Fisheries Research party from Lake Nipigon. In three of these stomachs they were associated with nymphs of Gomphus (see under *G. brevis),* while in the fourth they were the only species of dragonfly present. Stomach No. 1 contained 30 young nymphs of Macromia, the largest being about 11 mm. long; No. 2 contained 146 nymphs of this species and 18 of Gomphus (3 spp.), all young; No. 3 contained 13 Macromia (1 full-grown, 3 penult; 1 antepenult., and 8 younger nymphs of several stages); while No. 4, which was collected on Aug. 5, 1922, contained 13 Macromia nymphs (fragments of one nearly full grown, and 12 young, 11 mm. or less in length.)

33. *Tetragoneuria spinigera* (Selys). Four males were taken by Mr. Bigelow, one from Macdiarmid, June , 1921, and three from the Sand River, June 17, 1921. A half-grown Tetragoneuria nymph, doubtless this species, was taken from a small lake, near Macdiarmid, July 4, 1922.

The Carnegie Museum contains specimens with the following data: "At a little lake one mile west of Silver Islet, L. Superior, June 23, 1912," 1 ♂ (O. E. Jennings and R. H. Dailey); " On half-bare rocky headland along shore of L. Superior, Silver Islet, June 23, 1912," 2 ♀; "At north shore of L. Superior, 1912", 1 ♂ (O. E. J.); Orient Bay, 1 ♂ (G. K. Jennings.)

The specimens from this region are of very large size.

34. *Helocordulia uhleri* (Selys). A single male was taken by the writer while resting upon a tree trunk in a small clearing, close to the Pustagone River, July 14, 1920.

35. *Cordulia shurtleffi* Scudd. One of the commonest dragonflies of the region, found about all bog-margined ponds, lakes and streams. Nipigon, June 18-19, 1913, young adults and numerous exuvia in marshy places along the river; Pustagone River, Bear Creek and other quiet waters in the vicinity of Orient Bay, July 14-24, 1920; Macdiarmid, June 7-30, 1921, 2 ♂ 2 ♀; and Black Sturgeon Bay, 1922, 1 ♂ (Bigelow.)

Nymphs of various stages were collected by the Fisheries Research party as follows: Small lakes near Macdiarmid, Aug. 12, 1922, 7 full-grown; Aug. 13, 1922, 2 full-grown; Aug. 13, 1923, 3 full-grown (J. L. Hart); Aug. 15, 1923, 3 full-grown. 1 antepenult., 2 juv. (seine trawl, J. L. Hart); Black Sturgeon Lake, July 20, 1923, 1 full-grown (Bigelow.). Two young nymphs were found in the stomach of a golden-eye duck, collected by Mr. Snyder.

Specimens in the Carnegie Museum are as follows: Orient Bay, June 30, July 1922, 1914, 1 ♂ 1 ♀; Silver Islet. "on half-bare rocky headlands along shore of Lake Superior," June 23, 1912, 1 ♂ 1 ♀ tenerals; July 9, 1913, 1 ♂ (Mrs. Jennings).

36. *Dorocordulia libera* (Selys.) A male was found floating on a small, sluggish creek on the west side of Orient Boy, July 16, 1920. Another was captured on the same day on Bear Creek and a third at a very small, quiet stream, flowing into a small lake, connecting with the upper end of Orient Bay, July 18, 1920. This is the same stream at which *Somatochlora walshii, S. minor* and *S. elongata* were taken. There are also specimens in the Carnegie Museum, collected by Mrs. Jennings at the following localities :---Orient Bay, June 30-July 22, 1914, 2 ♂ and 6 miles west of Longuelac, July 15-16, 1917. 2 ♂ 1 ♀. I also took this species near Fort William on June 20, 1913.

A single nymph was taken from one of the small lakes above Orient Bay, Aug. 13, 1922.

37. *Somatochlora walshii* Scudd. Four males were captured by Mr. Kurata while flying over a small, quiet brook, July 18, 1920. (see preceding species.) A little patch of grassy marsh bordered the lower part of this stream. Some of the specimens were taken while flying over the marsh, while others were patrolling the stream.

The Carnegie Museum contains a female from Orient Bay, taken by Mrs. Jennings between June 30 and July 22, 1914. It has rather heavily flavescent wings.

38. *Somatochlora minor* Calvert. This species was often seen skirting the edges of Bear Creek and the Pustagone River, from July 14 to 22, 1920. A male was also taken on July 18 while patrolling the small stream on which the preceding two and the following species were captured. On July 16 and 20 *S. minor* was common on Bear Creek, most of the individuals seen being females. Several were observed ovipositing on the 16th. One of these was seen at the foot of a rapid, hovering in dense shade over the edge of the current, where the water broke into trickles among the small boulders. The others were engaged in this operation in the quieter water farther down the stream, under the overhanging vegetation along the bank. They flew irregularly back and forth close to the water, dipping the surface rhythmically with the projecting vulvar lamina. Another individual observed on the 20th, on the same stream tapped the wet mossy bank as well as the water. She would strike the water several times in succession, then the bank once, and repeat the operation more or less alternately but not regularly so. Subsequent observations have shown that this is the usual procedure with this species and *S. elongata*. and that the eggs are liberated freely in the water. Other specimens taken by the Fisheries Research party, consist of a male from a small upland lake near Macdiarmid, Aug. 112, 1922 (Bigelow) and a male, just emerged, taken at the Gull River on June 10, 1922 (S. Logier.)

Two full-grown nymphs attributed to this species, which I have reared at Lake Simcoe, were taken by Mr. J. L. Hart from a creek at Macdiarmid on Aug. 1, 1923. An exuvium was found by Mr. Bigelow on the wharf at Macdiarmid, on Aug. 1, 1922. This is an unusual situation for this species to select as a breeding place.

The Carnegie Museum contains specimens with the following data: "From clearings at Oliver Creek, Slate River Valley, July 1, 1913." 1 ♂ 2 ♀ ; six miles west of Longuelac, July 16, 1917, 1 ♂ ; 2½ miles west of Longuelac, July 15, 1917, 1 ♀ (G. K. & O. E. Jennings.)

39. *Somatochlora elongata* (Scudder.) A single male was taken on July 18, 1920, while flying over the same stream on which *S. walshii* was captured.

40. *Somatochlora williamsoni* E. Walker. This species appeared about its usual type of haunts—quiet shady streams with an imperceptible current. Two males were taken on July 18 and others were seen on the same date near the mouth of such streams and along the edge of a small shallow lake a few miles south of Orient Bay. On the following day several were observed flying over the open marsh at the mouth of the Pustagone. Three males were also taken by Mr. Bigelow at Black Sturgeon Bay, July 9-21, 1922, and one male at Wabin-

osh, July 28, 1923.

Specimens in the Carnegie Museum, taken by Mrs. Jennings, are as follows: Orient Bay, June 30, July 22, 1914, 1 ♂ ; lower end of Pelical Lake, about 7 miles from Sioux Lookout, Aug. 20, 1916, 1 ♂ ; Silver Islet Town, Aug. 4, 1912, 1 ♂ ; Hunt (on C.P.R. between Fort William and Sioux Lookout). Aug. 17, 23, 1917, 1 ♂ 1 ♀. The female from Hunt, taken Aug. 23, was observed "laying eggs on damp Scirpus stems, flying back and forth from them to the water."

41. *Somatochlora franklini* (Selys). Black Sturgeon Lake, June 20, 1922, 1 male with abd. segs. 4-10 wanting (Fisheries Research party). Sucker River, "2½ miles west of Longuelac, C.N.R., in pine wood, about half a mile from stream." July 21, 1917, 2 females (Mrs. Jennings, Carnegie Museum Collection.) Both of these females have small genital lobes.

We did not meet with this species in this region, but have since found its breeding place to be spring-fed bogs.

The related species *S. kennedyi* E. Walk and *S. forcipata* Scudd. are also regional here.

42. *Somatochlora albicincta* (Burm.) This species is not uncommon about quiet streams in the Nipigon region. I first met with it on the Nipigon River below Nipigon station, Aug. 4-6, 1910, when I took 1 male and 2 females flying over a reed bed around a small island in the river. It was not rare in the vicinity of Orient Bay during July 1920, but appeared to be somewhat local. We captured several males at or near the outlet of two small quiet streams on July 16 and 18. They are fond of hovering in the miniature bays or washouts in the banks of such streams or in the mouths of small tributaries. It was only once or twice, in such spots, that we observed this species on Bear Creek. A male was also taken by Bigelow at Virgin Isles, Lake Nipigon, Sept. 1923, and a female from Black Sturgeon Bay, July 21, 1922.

Two nymphs of the penultimate stage were collected by the Fisheries party, one from Shakespeare Bay, Aug. 12, 1921, and the other from a bay west of Cook Point, Lake Nipigon, July 30, 1921.

A male in the Carnegie Museum is labelled "North end of Lake Nipigon, Aug. 12-22, 1914" (Mrs. Jennings.)

43. *Somatochlora hudsonica* (Hagen.) In the Carnegie Museum there is a male of this species from the Sucker River, taken by Mrs. Jennings on July 21, 1917. It is mainly a northwestern species.

44. *Somatochlora cingulata* (Selys.) A rather small female of this species was taken while ovipositing in Bear Creek on July 21, 1920. She was in a little recess under the bank of the stream and was tapping the water very gently, keeping close to the surface. A nymph of the penultimate stage was taken by Mr. Hart in Bell Bay, Lake Nipigon, Aug. 16, 1923, and another was found in the stomach of a golden-eye duck, shot by Mr. Snyder.

There are five specimens of this species from the Thunder Bay District in the Carnegie Museum collection. These consist of a pair taken in copula on St. Ignace Island, Lake Superior, Sept. 5, 1912; a female from Orient Bay taken between June 30 and July 22, 1914, and a female from Grassy Lake, Silver Islet, July 9 (Mrs. Jennings.) Both specimens from St. Ignace Island are very large.

45. *Libellula quadrimaculata L.* Two worn specimens were taken on

July 18, 1920, while flying over a shallow marshy bay at the lower end of one of of the chain of lakes south of Orient Bay. A male and a female were taken at Macdiarmid by Mr. Bigelow on June 6, 1921.

The Carnegie Museum contains the following material: Silver Islet, June 23, 16 spec.; road to Loch Lomond (near Fort William), 6 spec.

46. *Libellula exusta julia* Uhl. This species was met with in considerable numbers on July 18, 1920, at the same marshy bay where the preceding species was taken. A male was also taken by Mr. Bigelow at Macdiarmid on June 16, 1921, and a female on July 8, 1922.

A number of nymphs representing several stages were found in the stomach of a golden-eye duck, shot by Mr. Snyder. Six nymphs were collected by Mr. Hart in a seine trawl from Cedar Creek Lake, near Macdiarmid, on Aug. 15, 1923. They represent four stages, the largest being full grown, the smallest measuring only 9 mm. in length.

The Carnegie Museum contains 12 specimens of the adult taken at Orient Bay by Mrs. Jennings and 26 specimens taken on the road from Fort William to Lock Lomond, June 25, 1912. All the specimens from this region are of larger size than those from Georgian Bay and southward.

47. *Libellula pulchella* Drury. This species has not been observed in the Nipigon region, which is perhaps beyond its northern limit, but the writer saw a specimen at Loch Lomond, near Fort William, on Aug. 2, 1910.

48. *Sympetrum scoticum* (Donov.) A teneral male was taken at a small pool in a ditch along the railway near Macdiarmid, July 21, 1920. This was one of the ponds where *Lestes disjunctus* was common. No other species appeared to inhabit them.

49. *Sympetrum costiferum* (Hagen.) The Carnegie Museum contains a specimen taken by Mrs. Jennings at the "north end of Lake Nipigon."

A half-grown nymph, apparently of this species, was found in the stomach of a golden-eye duck, together with many specimens of *Libellula exusta julia,* (q.v.)

50. *Sympetrum decisum* (Hagen). Two males of a very small size from the "north end of Lake Nipigon," taken by Mrs. Jennings, are in the Carnegie museum collection.

51. *Sympetrum obtrusum* (Hagen). A single male was taken at the marshy end of a small lake south of Orient Bay on July 18, 1920. The season had probably just begun about this time.

There is also a male in the Carnegie Museum from the "north end of Lake Nipigon. collected by Mrs. Jennings.

52. *Leucorrhinia frigida* Hagen. There are 8 males of this species in the Carnegie Museum taken by Mrs. Jennings at the "north end of Lake Nipigon" between June 30 and July 22, 1914. Seven of these are labelled July 22.

Two nymphs of the penultimate stage, probably of this species were taken from a pond near Fairloch, Aug. 13, 1922, by the Fisheries Research party.

53. *Leucorrhinia hudsonica* (Selys.) Nipigon, July 10, 1907, 3 females 1 male, (J. Fletcher); July 18-19, 1923, common in marshes along the river, many specimens, including a pair in copula, and a few exuvia. In the vicinity of Orient Bay it was fairly common but not abundant in all the marshes visited;

Bear Creek, July 16, 1920; shady creek south of Orient Bay, July 18, 3 females; marsh at mouth of the Pustagone, July 19 and 24. A female was taken at Macdiarmid by Mr. Bigelow on June 16, 1921. A nymph of the penultimate stage was collected by Mr. Hart in a small lake near Macdiarmid on Aug. 13, 1923.

A specimen in the Carnegie Museum was taken on the C.N.R., 5 miles north of Nipigon, July 6, 1912.

54. *Leucorrhinia proxima* Calvert, Nipigon, June 18-19, 1913, 2 females, one with exuvium (perhaps *L. glacialis.*) This was the commonest species of *Leucorrhinia* at Orient Bay in July, 1920, and though not abundant was found in all the marshes where collections were made. The first specimens were seen along Bear Creek on July 16 and were fully mature, and it was still common when we left on the 24th. Two males were taken by Mr. Bigelow on June 10 and July 3, 1921.

A single specimen from Orient Bay was noted in the Carnegie Museum collection.

55. *Leucorrhinia glacialis* (Hagen). This species was reported by Hagen from Michipicoten, Lake Superior (Thunder Bay District.)

A full-grown Leucorrhinia nymph, which appears to belong to this species was taken by Mr. Hart in one of the small lakes near Macdiarmid on Aug. 13, 1923. Two younger nymphs, probably of the same species were taken with it. Whether the nymphs of *L. glacialis* and *L. proxima* can be separated with certainty is an undecided point. *L. glacialis* is on the whole a rare and local species and the only authentic specimens of the nymph that I have examined are two exuvia collected by Professor Needham at Saranac Inn, N.Y., where it was reared.

ANNOTATED CHECK LIST OF THE MACROLEPIDOPTERA OF ALBERTA. ADDITIONS

BY KENNETH BOWMAN

Edmonton, Alta.

The following are additions to the "Check List of the Macrolepidoptera of Alberta" published by the Natural History Society, Red Deer, Alberta, in 1919.

The identifications were made by Dr. J. McDunnough, Dr. Barnes, Messrs Benjamin, Cassino and Swett to whom I am much indebted for their kindness. The numbers refer to the month of capture, the letters are abbreviations for the localities as given in the Check List. "W" is Waterton Lakes.

5	*Papilio bairdi* form *brucei* Edw.	6	E.
16	*Papilio eurymedon* Luc.	6.7	W.
59	*Eurymus eurytheme* ab. ♀ *pallida* Ckll.	8	E.
225	*Melitaea damoetas* Skin.	6.7	W.
395	*Satyrium fuliginosa* Edw.	7	W.
402	*Heodes dione* Scud.	6.7	C.H.W.
408	*Heodes dorcas* Kirby	7.8	N.E.R.
414	*Heodes heteronea* Bdv.	6.7	W.
694	*Sphinx gordius* Cram.	6.	N.
N.S.	*Sphinx mordecai* McD.	6	Bm.
707	*Paonias excaecata* A. & S.	6	R.
1090	*Heliothis obsoleta* Fabr.	8	C.
1097	*Rhodophora gaurae* A. & S.		Lb.

1191	*Schinia jaguarina* Gn.	8	Lb.
1210	*Canthylidia scutosa* Schiff.	7	Lb.
1215	*Copablepharon longipennis* Grt.	7.8	Lb.
1240	*Euxoa olivia* Morr.	8	Lb.
1241	" *brevipennis* Sm.	8	Lb.
1272	*Euxoa detersa personata* Morr.	8	Lb.
1336	" *pleuritica* Grt.	7	Lb.
1365	" *atrifera* Grt.	8	Lb.
N.S.	" *dodi* McD.	8	Lb.
N.S.	" *clausa* McD.	7	Lb.
N.S.	" *lindseyi* Blackmore	8	C.
1475	*Epipsilia monochromatea* Morr.	7	E.
1503	*Lycophotia nanalis* Grt.	9	Lb.
1504	*Adita chionanthi* A. & S.	8	Lb
1525	*Anytus evelina* French	9	Lb.
1606	*Barathra configurata* Wlk.	8	Lb.
N.S.	*Anarta poca* Barnes & Benj.	5.7	N.P.
N.S.	*Lasionycta alberta* Barnes & Benj.	7	N.Bm
1686	*Polia subjuncta* G. & R.	7	Lb.
1789	*Trichoclea fuscolutea* Sm.	6	Lb.
1888	*Xylomyges rubica* Harvey	5.6	Lb.
2031	*Oncocnemis sanina* Sm.	8.9	Lb.
2032	" *simplex* Sm.	8.9	Lb.
2064	" *major* Grt.	7	Lb.
N.S.	" *lepipoloides* McD.	8	Lb.
2211	*Conistra signata* Frch.	9-10	Lb.
2241	*Amphipyra glabella* Morr.	7-9	Lb.
2271	*Trachea delicata* Grt.	7	Lb.
N.S.	" *pluraloides* McD.	7	Lb.
N.S.	*Euplexia veresimilis* McD.	6.7	E.C.
2335	*Oligia fractilinea* Grt.	7	Lb.
2366	*Sidemia longula* Grt.	7	Lb.
2559	*Hadenella pergentilis* Grt.	6	Lb.
N.S.	*Escaria homogena* McD.	6	Lb.
2579	*Caradrina meralis* Morr.	8	Lb.
2586	*Acopa perpallida* Grt.		Lb.
2615	*Xylomoea didonea* Sm.	8.9	Lb.
2759	*Stiria rugifrons* Grt.	8	Lb.
3055	*Catocala parta* Gr.	8	Lb.
3056	" *luciana* Stkr.	9	Lb.
N.S.	" *orion* McD.	8	Lb.
3289	*Raphia frater* Grt.	5	E
3290	" *coloradensis* Put.	6-7	Lb.
3536	*Bleptina caradrinalis* Gn.		Lb.
3620	*Nadata gibbosa* A. & S.	6	R
3863	*Acidalia subfuscata* Tayl.	6	Bm
N.S.	*Dysstroma mackieata* Cass. & Swett.	6	E

4180	*Eupithecia lagganata* Tayl.		L
N.S.	" *inclarata* Cass & Swett.	6	
N.S.	" *divinula* Cass. & Swett.	7	
N.S.	" *bowmani* Cass. & Swett.	6.7	P.N.
4231	" *togata* Hbn.	7	R
4350	*Macaria oweni* Swett.	6	R.E
4399	*Itame ribearia* Fitch.	7	Lb.

The following should be eliminated from the list, having been proved to be other species.

61 *Eurymus occidentalis* Scud
205 *Euphydryas colon* Edw.
401 *Heodes xanthoides* Bdv.
1567 *Rhynchagrotis morrisonistigma* Grt.
1642 *Anarta hampa* Sm.
2317 *Euplexia lucipara* L.
3977, 1 *Lygris populata L.*
4689 *Gonodontis duaria* Gn.

THREE NEW SPECIES OF AGROMYZA AND SYNONYMICAL NOTES (DIPTERA, AGROMYZIDAE)

BY J. R. MALLOCH,
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The type specimen of *Agromyza holti* will be deposited in the U.S. National Museum; those of the other two species are in the collection of the writer.

Agromyza reverberata sp. n.

Female.—Lemon yellow, slightly shining. Ocellar spot reddish; third antennal segment and arista black. Thoracic dorsum with five black vittae, the outer one on each side sometimes indistinct, median one broad, extending from anterior margin to midway from suture to posterior margin, submedian vitta almost touching median one, not extending as far forward but continued as a narrow line almost to posterior margin, slightly interrupted at suture, the anterior part broadest, lateral vitta narrow, not extending in front of suture; metanotum blackish. Apical abdominal segment shining black. Legs yellow. Wings clear. Margins and fringes of calyptrae blackish. Halteres yellow.

Each orbit with three or four bristles, the hairs almost absent; ocellar and postvertical bristles long; arista pubescent, slender; third antennal segment rounded at apex; cheek of moderate height. Thorax with four pairs of dorsocentrals, and some fine setulae. Inner crossvein below apex of first vein and close to middle of discal cell, last section of fourth vein about three times as long as discal cell, last section of fifth vein about one-fifth as long as preceding section; costa ending in tip of wing at apex of fourth vein.

Male.—Similar to female, hypopygium pale.

Length, 1.5—2 mm.

Type and *paratype,* Glen Echo, Md., May 14, 1922 (J. R. Malloch).

Allotype, topotypical, June 11, 1922. One male *paratype*, topotypical, May 26, 1923. Same collector.

Agromyza holti sp. n.

Female.—Yellow, marked with black, subopaque. Head with upper half of occiput, ocellar spot, and labrum black. Entire disc of thorax black, densely gray pruinescent, the lateral margins and posterior lateral margins pale yellow; scutellum pale yellow, with a black mark on each side at base; a large, black mark on sternopleura and a smaller one on mesopleura below. Abdomen black, paler

on sides posteriorly. Legs yellow, hind tibia brown. Wings clear. Calyptrae and their fringes, and halteres yellow.

Head similar to that of *pusilla* Meigen, but the third antennal segment is angulated above at apex. Thorax with two pairs of dorsocentrals and some discal setulae. Apical abdominal segment stout. Costa to apex of fourth vein, the latter ending in tip of wing; crossveins very close together, separated by about length of inner; last section of fourth vein about seven times as long as discal cell; last section of fifth vein about three times as long as preceding section.

Length, 1.25 mm.

Type, Ardmore, S.D., August 13, 1915 (E. G. Holt). Named in honor of the collector.

Agromyza pallidiseta sp. n.

Female.—Black, densely gray pruinescent, abdomen slightly shining. Head lemon yellow, occiput on upper half and frons on upper third blackish, arista brown except at base. Legs lemon yellow. Calyptrae and their fringes whitish. Wings clear, veins gray, paler basally. Halteres whitish. All hairs and bristles yellowish.

Each orbit with four fine bristles, otherwise almost bare; antennae rather large, third segment rounded; arista short and rather thick, not as long as anterior width of frons; cheek posteriorly nearly half as high as eye. Thorax with four pairs of dorsocentrals, the anterior pair weak; pre-sutural acrostichals distinct. Apical segment of abdomen prolonged, the tip slightly knobbed. Fore femur with some fine posteroventral bristles; mid tibia without posterior setulae. Costa to fourth vein; inner crossvein well beyond apex of first vein and at one-third from apex of discal cell; penultimate section of fourth vein barely longer than outer crossveins and not over one fourth as long as ultimate section; last section of fifth vein about two-thirds as long as preceding section; fourth vein ending slightly behind apex of wing.

Length, 2 mm.

Type, Rock Creek Park, D.C., May 28, 1922 (J. R. Malloch).

This species belongs to the group dealt with in my "Partial Key to the Genus Agromyza," Fourth Paper, Can. Ent., 1918, p. 315 and will run to caption 8, where it separates from the others by the entirely yellow legs, and yellow bristles and hairs.

Agromyza nasuta Melander

I redescribed this species under the specific name *youngi* from New York. Melander made no mention of the presence of three pairs of dorsocentral bristles on the thorax of his species but I have seen some of his material and find that this character, unique in this segregate, is present. The species mines dandelion; *maura,* of which Melander listed it as a variety, mines in *Delphinium.*

Apparently Handel has redescribed *nasuta* under the name *madizina* from Europe, citing as a character for its separation from *pinguis* Fallen the presence of three instead of two pairs of dorsocentrals and he lists *nasuta* as a synonym of *pinguis* evidently being misled, as I was, by the omission of the number of dorsocentrals in Melander's description.

Agromyza angulicornis Malloch

This species has evidently been redescribed by Handel from Europe under the specific name *angularis.*

NEW CANADIAN DIPTERA, WITH SYNOPSIS OF THE GENUS *CYNORHINA*.*

BY C. HOWARD CURRAN,
Ottawa, Ont.

The material described in the following pages has come to hand during the past two or three years. The types are deposited in the Canadian National Collection, Ottawa.

DOLICHOPODIDAE

Hydrophorus purus new species

Knobs of halteres black, anterior femora with two yellow compressed specialized bristles before the apex on the anterior surface.

Length, slightly over 3 mm., of wing 4.25 mm. *Male.* Face narrow, rather strongly widened below, the upper part green, covered with brownish pollen, the lower section black, covered with more silvery pollen, but this is diffuse with the brown above and laterally. Front and occiput opaque black, the former with brownish pollen in some lights, the latter greyish pollinose on the lower half. Beard moderately thick, white. Palpi silvery with some very short, stout whitish hairs and some longer black ones along the inner border and apex. Antennae black, not large, the third joint rounded apically, with a small triangular projection above the lower corner.

Mesonotum deep green, with a broad bronze vitta on either side, the brown pollen forming darker areas elsewhere. Acrosticals small, in a single row; dorso-centrals well developed, of even length. Pleura bright bronzy green, with covering of greyish pollen; one black bristle above the front coxae.

Legs green, the coxae, trochanters and tarsi black. Anterior femora with a double row of short, stout bristles on the antero-ventral surface, terminating in two specialized, longer flattened and broadened yellowish ones, the anterior row of bristles not much over half as long as the posterior. Anterior tibiae with a row of short bristles commencing on the anterior edge at the base and gradually running under the tibiae, until in the apical third they are entirely ventral, although the row curves forward again just before the apex, the bristles shorter on the basal fifth. All the coxae are covered with argenteus pollen and fine white hairs.

Wings cinereous hyaline, the costa slightly thickened and tapering from the tip of the first vein, the posterior crossvein with a slight outward bow, not transverse. Squamae and halteres yellow, the former with fine white ciliae, the latter with the knob brown on the head.

Abdomen bright deep green, the disk thinly brown pollinose.

Holotype. ♂, Reston, Man., August 2, 1922, (H. A. Robertson); No. 707 in the Canadian National Collection, Ottawa.

This species is very similar to *H. claripennis,* V.D., but is readily distinguished by the bristles on the front tibiae. In *claripennis* the bristles are all of practically even length and there is scarcely a trace of deviation from the antero-ventral surface, and the bristles are not at all concentrated apically as is the case in *purus*. In *purus* the hair on the front coxae is pure whitish and subappressed, while in *claripennis* it has a yellowish tinge, is erect and more abundant.

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

TACHINIDAE

Eulasiona nigra new species

Length, 6 to 7 mm. *Male.* Entirely black; middle of face and narrow interrupted bases of each abdominal segment silvery greyish pollinose, the mesonotum, facial and frontal orbits, and occiput greyish yellow pollinose, the pleura with greyish pollen. Front at the narrowest point not wider than the distance between the outer edges of the posterior ocelli, the median vitta opaque black. Frontal bristles fine, most of them over two-thirds as long as the arista, extending down the sides of the face, along the middle of the parafacials, almost or quite to the cheeks; hairs of cheeks long, the oral vibrissae longer than the arista.

Three ps. dsc., two prs. dsc.; six strong acr., three before and three behind the suture. Two sternopleurals.

Legs with rather strong bristles, the middle tibiae with a single median anterior bristle, the hind ones with five or six antero- and four postero-dorsal bristles between which is a ciliate row of short bristles on either of these surfaces, and an anterior row of short bristles.

Wings cinereous, the basal portion black, third vein with one bristle.

Second abdominal segment with two discal, the third with three discal pairs of macrochaetae.

Female. The female has the front at the antennae about one-third the width of the head, at the vertex about one-quarter the width, and there are two strong forwardly directed orbitals. The base of the wings is paler than in the male, but not at all yellowish. There are no discal macrochaetae on the second segment of the abdomen, but one or two pairs on the third segment.

Holotype. ♂, Victoria, B. C., July 5, 1923, (K. F. Auden); No. 705 in the Canadian National Collection, Ottawa.

Allotype. ♀, same data.

Paratypes. 2 ♂, 2 ♀, Victoria, B. C., July 5 and 9, 1923, (Auden).

The above specimens were reared from *Cacoecia rosana* larvae. This species differs from *comstocki* in having black wing base, stronger and more numerous frontal and facial bristles and much more restricted pollen on the abdomen.

SYRPHIDAE

Some time ago I completed a revision of the Syrphid genera Criorhina, Cynorhina, etc., which has not yet been published. At the time a number of new forms were recognized. Two species not previously seen have come to hand and I take pleasure in naming them in honour of the collectors.

Cynorhina garretti new species

Allied to *armillata* O.S. but the face is decidedly longer and only the lower third or less of the front is reddish, as compared with the lower two-fifths, the antennal prominence is shorter; it is perhaps better separated by the yellow haired posterior four coxae, these parts being typically black-haired in *armillata.*

Female. Length 9 mm. Face and lower third of front reddish; cheeks shining black, orbital margins and lower half of black portion of front pale yellowish pollinose; front and occiput black, wholly brassy yellow pilose; facial side margins short pale yellow haired. Antennae reddish, third joint large, orbicular; arista long, black.

Thorax and scutellum shining black, the dorsum bronzed, wholly yellow pilose, the dorsal margins with more fulvous hair.

Legs black, apices of femora, bases and apices of tibiae and first three joints of all the tarsi reddish yellow.

Wings luteous, the veins narrowly more brownish, stigma brownish luteous.

Abdomen shining black, black pilose, the sides basally, large triangles on the base of the second segment, almost meeting in the middle, and side margins of last three segments, reddish yellow pilose.

Holotype. ♀, Hedley, B. C., July 29, 1923, (C. B. D. Garrett); No. 692 in the Canadian National Collection, Ottawa.

Paratype. ♀, Banff, Alta., August 2, 1922, (Garrett).

Cynorhina bigelowi new species

Differs from *C. nigra* Williston in having the face and front wholly shining black, destitute of pollen, the first two antennal joints brown, the face slightly longer and less sharply but slightly more produced below.

Female. Length, 8 mm. Wholly shining black; the antennae brown with the third joint reddish, sub-orbicular slightly longer than wide, somewhat oblique. Front without pollen, its pile short, brassy yellow, the pile elsewhere on the head white.

Thorax with short yellowish pile, a few black bristly hairs about the base of the wings.

Femora largely black pilose, but all the pile on the legs is short, the tibiae almost bare.

Wings slightly brownish, the base slightly yellowish; stigma luteous.

Abdomen short whitish pilose, the apical margins of the third and fourth segments with short blackish pile.

Holotype. ♀, Macdiarmid, Ont., (N. K. Bigelow); No. 693 in the Canadian National Collection, Ottawa.

The following is a synopsis of the Nearctic and Palaearctic species.

CYNORHINA—TABLE OF SPECIES.

1. Face entirely yellow, the cheeks may be black 2
   Face with a medium black stripe or wholly black 12
2. Scutellum partly or wholly yellow 3
   Scutellum entirely dark 6
3. Abdomen entirely black, scutellum wholly yellow ..... *johnsoni* Coq.
   Abdomen in part yellow 4
4. Sides of mesonotum not yellow behind the suture, the apex of the scutellum narrowly yellow ..... *humeralis* Willist.
   Sides of mesonotum yellow behind the suture, at least in large part, scutellum broadly yellow 5
5. Dorsum of thorax yellow laterally behind the suture. The yellow continued as an even scutelar margin ..... *pictipes* Big.
   Dorsum of thorax yellow laterally only behind the wing base, the apical half of the scutellum yellow ..... *notata* Wd.
6. Hind femora yellow on the basal half ..... *humeralis* Willist.
   Hind femora with the basal half or more black 7
7. Legs wholly black, at most the joints slightly reddish ..... *nigripes* Curr.
   Legs with the broad basis of one or more pairs of tibiae or two or three

tarsal joints reddish or yellow 8
8. Abdomen entirely black 9
Abdomen in part reddish or yellow 10
9. Only the lower third of the front reddish, posterior 4 coxae, yellow pilose ..... *garretti* n. sp.
Lower two-fifths or more of the front reddish, posterior, four coxae black pilose ..... *armillata* O.S.
Front wholly black 14
10. Humeri and posterior of the mesopleura yellow ..... *scitula* Willist.
Humeri black, although they may be dusted with pale pollen 11
11. Front of ♂, with a black middle line, of the ♀ wholly black, (Europe) .... *fallax* L.
Frontal triangle of ♂, wholly; front of ♀ before the ocelli, reddish ..... *analis* Macq.
12. Wholly black, including the face and legs ..... *bigelowi* n. sp.
Either the face, abdomen or legs partly pale 13
13. Abdomen wholly black 14
Abdomen with pale markings 15
14. Large 11 mm.; the lower half of the face rather fuscous; the thorax with longish pale yellow pile; two or three tarsal joints, clearly reddish yellow ..... *robusta* Curran.
Smaller, face, largely diffusely black or brown, pile all short, tarsi not clearly reddish, more fuscous ..... *nigra* Willist.
15. The scutellum partly yellow ..... *metcalfi* Curran
Scutellum wholly black 16
16. Face wholly black in ground color, the sides densely pale pollinose ..... *umbratilus* Willist.
Face yellow, the middle line black 17
17. Hind femora broadly yellow at base ..... *badia* Walk.
Hind femora black at base ..... *confusa* Johns

A REVISION OF THE NEARCTIC SPECIES OF THE GENUS GONIA (DIPTERA, TACHINIDAE).*

BY J. D. TOTHILL,
Fredericton, N. B.

The genus *Gonia* includes a number of species that are important parasites of cutworms and the present revision of the genus is an outcome of attempting to determine material bred by Mr. E. H. Strickland who was for some time engaged by the Entomological Branch in connection with studies of cutworm outbreaks in Alberta. Material for study was kindly loaned by the United States National Museum, the Boston Society of Natural History, and from the private collections of Dr. J. M. Aldrich and Mr. C. W. Johnson; this material together with that in the Canadian National Collection has formed the basis for the present study. It was found that color markings and the relative length of the second aristal segment were too variable to be of much value in separating species and the chief reliance has been placed on the structure of the forceps of the male genitalia, although in the key to the species auxiliary and more readily seen characters have been used wherever possible. When more material becomes available

*—Contribution from the Entomological Branch, Department of Agriculture, Ottawa.

it will doubtless be found that one or two of the species of this revision will need to be subdivided and that additional species will be collected. Little attempt has been made to study the females.

The term *Gonia* was proposed by Meigen in 1803 but no species were attached until 1826 when 13 species were included. The genotype, by designation of Curtis in 1835, is *Musca capitata* De Geer.

The genus is characterized by the backwardly directed ocellar bristles, the presence of orbital bristles in both sexes, the wide front, the great length of the third antennal segment as compared with the second in the males, and by the habit of ovipositing microtype eggs that are placed on the food of the host.

In the sixteen species before me the vibrissae are well above the oral margin. The palpi are yellow. Cheeks (genae) white pollinose covered with hairs on the lower three-fourths. Sides of the face (parafacials) white pollinose and hairy. Facial ridges bristly on lower fifth. Facial depression white pollinose with a feebly developed median carina; first two antennal segments yellow. The arista is thickened practically throughout, the first segment of varying length and frequently longer than the second. The front is more than twice as wide as either eye in both sexes—wider in the females; the sides of front white pollinose above the antennae, becoming somewhat subshining on either side of the ocellar triangle; the frontal vitta opaque, pale buff in color, and always much narrower than either of the frontal sides at the narrowest place.

Thorax with four sternopleural bristles and four postsuturals. Scutellum with three pairs of strong marginal macrochaetae and with a weak terminal pair, usually with a single, somewhat weak, pair of discals. Legs black or mostly so, the hind tibiae regularly or irregularly ciliate, varying within the species. Venation of the standard pattern M_{1+2} (fourth vein) being destitute of an appendage. Tegulae white.

The small number of purely eastern species and the large number of western ones seems to indicate a western origin with a slow development as the genus spread over the continent starting from the north-west corner. On the other hand the small number of European species seems to point to dispersion from Asia. A Behring Sea landbridge during the early development of the genus would suffice to explain the obviously close relations existing between the present nearctic and palaearctic species. As none of the nearctic and palaearctic species seem to be identical, sufficient time has elapsed since the disappearance of the bridge to permit of further slight specialization. The question will remain obscure until the Asiatic species have been worked up.

KEY TO THE NEARCTIC MALES OF THE GENUS GONIA.

1. First vein (R_1) bristly at the base ..... 1. *setigera* n. sp.
   First vein without bristles 2
2. Third segment of the antennae reddish 3
   Third segment of the antennae black 4
3. Genal hairs pale yellow, forceps only twice as long as median width and blunt ..... 2. *senilis* Will.
   Genal hair fuscous, forceps three times as long as median width and not unusually blunt ..... 3. *sagax* Tn.
4. Parafacials unusually wide, narrowest width from eye to ptilinal suture being

greater than greatest eye width .....4. *turgida* Coq.
Wides of parafacials equal to or less than greatest eye width 5
5. Pleura with golden pile, lobes of fifth sternite yellow, ...5. *porca* Will.
Pleura without golden pile, the sternal lobes black 6
6. Lobes of the last sternum unusually large and excised medially on the ventral margin; forceps very large and cleft to beyond the middle from apex .....6. *fissiforceps* n. sp.
Without this combination of characters 7
7. Parafacials unusually narrow, the narrowest width to ptilinal suture being less than twice length of second antennal segment .....7. *distincta* Sm.
Parafacials at least 2½ times length of this segment 8
8. The pile on the occiput brown .....8. *fuscicollis* n. sp.
The pile on the occiput white 9
9. Forceps unusually slender, without a conspicuous carina, the median width equal to 1-5 the length; shortest distance from eye to ptilinal suture almost or quite equal to greatest eye width .....9. *longiforceps* n. sp.
Forceps stouter or with a conspicuous carina, and parafacials narrower ..10
10. Forceps with a strongly developed keel as deep as the forceps are thick and extending for ¾ length of forceps .....10. *carinata* n. sp.
Forceps with at most a feebly developed or shorter keel 11
11. Genal hairs pale straw-colored in profile view and forceps as broad as long .....11. *sequax* Will.
Genal hairs fuscous or black or if pale-colored then forceps much longer than broad 12
12. Forceps unusually long and wide tapering gradually so as to be almost triangular in shape and strongly flattened dorso-ventrally .....12. *aldrichi* n. sp.
Forceps shaped differently 13
13. Forceps arcuate in profile on ventral surface and short .....13. *frontosa* Say.
Forceps straight in profile on ventral surface 14
14. Forceps with notch extending at least 2-5 from apex to base .....
.....14. *yukonensis* n. sp.
Forceps with shallower notch 15
15. Forceps short, when viewed in profile the declivity on their dorsal surface starts at or close to the middle, the parafacials only slightly wider at antennal base than at vibrissae .....15. *breviforceps* n. sp.
Forceps of normal length, when viewed in profile the dorsal declivity starts at least 2-3 from base, and the parafacials much wider at antennal base than at vibrissae 16
16. Pulvilli longer than the last tarsal segment .....16. *longipulvilli* n. sp.
Pulvilli shorter than the last tarsal segment .....17. *brevipulvilli* n. sp.

In the following descriptions reference is made only to such characters as are not included in the generic description. When comparative distances are given, such as the narrowest width of the parafacials as compared with the length of the second antennal segment, it means that measurements have been made with an eye piece micrometer fitted to one tube of a binocular microscope. In measuring the parafacials the distance has been taken from eye margin to the nearest point on the ptilinal suture rather than to the somewhat indefinite vibrissal

ridge. The forceps of the genitalia is the large conspicuous clasping organ, the accessory plate being almost vestigial; it is necessary to spread the forceps in order to examine them.

1. **Gonia setigera** n. sp.

Parafacials at narrowest point about three times the length of second antennal segment and considerably wider at antennal base. Genal hairs fuscous. Third antennal segment black. Occipital pile white. Pleura without golden pile. First vein (R1) bristly at base, third vein bristly about ¾ distance to small cross vein. Abdomen reddish yellow laterally and ventrally, median dorsal line black widening out posteriorly to include the fourth and in one case part of the third tergum.

The forceps of ♂ genitalia short with the ventral margin straight in profile. Dorsally the declivity in profile starts at about the centre. Extreme length almost three times median width.

Holotype—♂, Essex,Mass., June 20, (A. B. Fuller); in the Museum of the Boston Society of Natural History.

Allotype—♀, same data.

Paratypes—♂, ♀, same data, No. 781 in the Canadian National Collection, Ottawa; 2 ♂, several ♀, same data; 1 ♀, Los Angeles, Calif. in the United States National Museum.

2. **Gonia senilis** Will.

Parafacials at narrowest point from two and a half to three times the length of the second antennal segment and about half as wide again at the antennal base. Genal hairs pale yellow particularly the tips as viewed in profile. Third antennal segment yellow and consequently very striking in appearance. Occipital pile white. Pleura without golden pile. First vein without bristles, those on the third vein extending half way to the small cross vein. Abdomen yellow with broad grey pollinose transverse bands on the bases of the segments and with a median black stripe that widens posteriorly to include a good deal or all of segments three and four. The tergites are generally yellow but in a few specimens black.

Forceps short and blunt, about twice as long as median width; almost as wide across the base of the apical cleft as at the middle. The dorsal declivity as viewed in profile starts at the middle of the forceps.

Redescribed from seventeen males taken at College Park, Indiana; Oak Grove, Virginia; Riverton, New Jersey; Thomasville, Georgia; and Miami, Florida. Williston also records the species from southwestern Kansas.

3. **Gonia sagax** Towns.

Parafacials at narrowest point about three times the length of the second antennal segment and not much wider at the antennal base. Genal hairs fuscous. Third antennal segment yellow and consequently very striking in appearance. Occipital pile white. Pleura without golden pile. First vein without bristles, those on the third vein extending about one-third the distance to the small cross vein. Abdomen black the sides obscurely yellow in one specimen.

Forceps of medium length and not blunt as in *G. senilis* Will. About three times as long as median width and much narrower across the base of the apical cleft than at middle.

Easily distinguished from *G. senilis* Will. by the fuscous genal hairs, the

wider facialia, the darker abdomen, and by the structure of the inner forceps.

Redescribed from two males taken at Middlesex County, N.J., and Hartford, Conn.

As the type does not appear to be extant, the New Jersey specimen is selected as a neotype and retained in the Canadian National Collection, Ottawa.

4. **Gonia turgida** Coq.

Parafacials extremely wide being considerably wider than an eye even at the narrowest place and being considerably fuscous. Third antennal segment black. Occipital pile white. Pleura without golden pile. First vein without bristles; the third vein with bristles extending less than half way to the small cross vein. Abdomen reddish yellow except for a black dorsal stripe that widens posteriorly so as to embrace most of the fourth tergum.

The forceps of genitalia of medium length without a carina. In dorsal view triangular in shape the sides tapering gradually from the somewhat wide base to the apex. The dorsoventral flattening considerable. The ventral surface straight in profile.

Redescribed from a male taken by E. G. Holt at Round Mountain, Nevada, 6,300 ft.

Dr. Aldrich has furnished the following note which should make this species more easily determinable.

"I have examined the type of *turgida* in comparison with the specimen you returned. I now believe they are the same. Your specimen does not show the striking color pattern of a perfect specimen, which ought to be mentioned. To the naked eye, in a favorable light, the fly seems to have a broad median stripe the whole length, yellow on head and scutellum, elsewhere black. The rest of the surface is whitish-pollinose to the sides (to the eye of course on the head). The effect is of three stripes covering the whole fly dorsally, the median dark, the two lateral almost white. No other Gonia has this as far as I know."

(To be Continued)

A NEW VARIETY OF CICADA

BY R. H. BEAMER,
University of Kansas, Lawrence, Kansas.

While collecting *Tibicen pruinosa* Say, in Cherokee County, Kansas, the past several years, a few very light-greenish tan colored individuals were taken, just one or two each season, not enough to warrant the making of a new color variety. During last August (1923) twenty-one specimens of this light-colored variety were taken, some of them under conditions which we believe supply sufficient evidence to show that they belong to a true color variety and are not immature forms as one might at first think.

The males sing just like the males of *Tibicen pruinosa* Say. No difference could be detected at all. Out of twelve males, located by their songs and taken in one evening, four were of this light color and the rest were of the regular dark form. About this same proportion was noticed on other occasions.

Two females were observed ovipositing. One was shot down while ovipositing in the dead branch of an ash tree, and her ovipositor was left inserted in the wood when she fell from the twig. The specimen and the twig with the broken end of the ovipositor sticking in it are in the Snow Collection at the

University of Kansas. The other female was observed while making several punctures in the heavy bark of a green elm limb which was about four inches in diameter. This individual was taken alive and placed in a cage in the hope that she could be induced to oviposit in captivity. This, however, failed, the female dying at the end of about two days, but still retaining the light color.

Another argument in favor of this being a mature form is that it seems to be confined to this one locality. *Tibicen pruinosa* Say are quite numerous all over the eastern part of Kansas and a great number of them have been taken, especially in Douglas County, but not a single light colored form has been found other than from the one locality. I am therefore convinced that this is a true color variety and describe it as such below:

Tibicen pruinosa Say, var. **fulva** new variety

Tibicen pruinosa Say, var. *fulva,* differs from *Tibicen pruinosa* Say in its general ground color, which is tan or buff on the dorsum of the abdomen with a greenish tinge added on the thorax and some black spots on the head, while that of *T. pruinosa* is black on the abdomen and green and black spotted on the thorax and head. It also differs very conspicuously in having a light buff colored band encircling the eyes while the eyes of *Tibicen pruinosa* Say are margined with black.

The head in general proportions is like *T. pruinosa* Say, the dark markings being less extensive and the light markings generally lighter. The pronotum is about the same as in *T. pruinosa* Say, but has less distinct dark markings. The mesonotum is almost devoid of black markings, the W mark of typical *pruinosa* being but faintly outlined. There remain two black spots between the anterior arms of the x, usually near the tip, a somewhat larger spot on each side of the x, and an indication of a dark spot between the posterior arms of the x. Some golden colored pile is scattered about the head and thorax on the rugosities and their corresponding declivities. The dorsum of the abdomen is light tan or buff in general ground color with the typical pruinose spots on segments one, three and eight. Also there is a lateral row of darker colored spots which vary somewhat in extent. The abdomen is also covered with a sparse layer of pile, part of which is black and part golden, the two colors fairly well mixed.

The venter is pruinose throughout with the exception of a broad median line on the abdomen which seems to be polished tan, as though it had been rubbed. No black spots on the segments caudad to the opercula as in *T. pruinosa* Say.

Genitalia as in the typical *T. pruinosa* Say, except in the color of the uncus which is light tan with a slight infuscation at the tip.

The holotype was taken Aug. 18 and the allotype Aug. 27, 1923, in Cherokee

The wings are the same as in typical *pruinosa* Say in every way.

County, Kansas. Their measurements are as follows:

Measurements in Millimeters

	Male Holotype	Female Allotype
Length of body	36	31.5
Width of head across eyes	14.5	14
Expanse of forewing	44	43
Width of forewing	15	14

In addition to the above there were twenty-one specimens taken, four of

which are females and the rest males, all of which are labelled paratypes and in the collection at the University of Kansas, except one pair, which is in the Davis Collection, New Brighton, Staten Island, N.Y. Two of this number were taken in 1917, one in 1920 and the rest in 1923, all of them being from Cherokee County, Kansas.

A REMARKABLE ICHNEUMONINE*

BY H. L. VIERECK,
Ottawa, Ont.

Exeristoidea new subgenus.

Differs from *Exeristes* in its *Rhyssa*-like clavate abdomen and in its unusually long ovipositor which is over four times as long as the body.

Genotype—Ichneumon (Exeristoidea) watsoni new species.

Ichneumon (Exeristoidea) watsoni new species

Female. Length 17 mm., ovipositor approximately 78 mm. Head concolorous with the thorax and abdomen, black excepting the pale appendages as follows: —palpi blackish at base, mostly whitish, legs reddish to yellowish excepting the hind tibiae which are yellowish at base, thence blackish with the underside reddish, hind tarsi blackish, wings pale, infuscated; face polished rather indefinitely, irregularly, sparsely punctured, clypeus impressed, emarginate; notauli represented only on the anterior third of the mesonotum; propodeum transversely wrinkled and striate, the two parallel welts down the middle nearly to the end of the basal third, apical third mostly polished, seen from above the outer line is humped near the base owing to the presence of an eminence above the spiracles; first tergite length is to its width at apex as 45 is to 35, second tergite length is to its width at apex as 42 is to 48, first tergite dorsally concave between two longitudinal welts, second tergite with an oblique furrow extending from near the middle of the anterior margin to the thyridia on each side or about one half the distance from the base to the apex of the tergite, first and second tergites with the apical edge partly yellowish.

Holotype— ♀, Queen's Park, Aylmer, Que., June 15, 1924 (E. B. Watson), No. 919 in the Canadian National Collection, Ottawa.

Paratypes—3 ♀, Queen's Park, Aylmer, Que., June 20, 22, 26, 1924, (E. B. Watson, H. L. Viereck, C. B. Hutchings.)

The specimens cited above were taken either near or on logs at the Entomological Branch Laboratory, Aylmer. The logs in question were infested by various Coleoptera, among which may be the host of this species of parasite.

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa, Ont.

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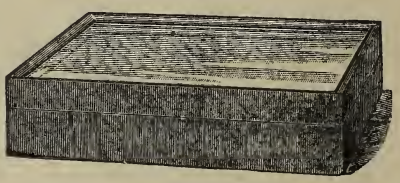

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